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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/879,556	06/12/2001	Jong-Hyon Ahn	SAM-0201	4592

7590

08/13/2003

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EXAMINER

HU, SHOUXIANG

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 08/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/879,556	AHN, JONG-HYON	
	Examiner	Art Unit	
	Shouxiang Hu	2811	H

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 June 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) 5-7 and 10-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 8 and 9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

1. This application claims the priority under 35 U.S.C. 119 based on priority application serial No. 00-64557, filed on 11/01/2000 in Republic of Korea.

Pending Claims

2. Claims 1-18 are pending in this application; and claims 1-4, 8 and 9 remain active in this Office action, in view of the previous Office action.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 2, 8 and 9 are rejected under 35 U.S.C. 102(e) as being anticipated by Usami (US 6,589,863).

Usami discloses an interconnection structure for a semiconductor device (Figs. 2a-7; also see cols. 9 and 10), comprising: a trench formed in an ILD film (2-5 and 12-4); a barrier layer (the remaining portions of 8 and 18; TiN); and a conductive layer (the

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remaining portions of 10 and 19; Cu), wherein a lower portion of the trench (the portion that is formed in layers 5 and 6) is wider than an upper portion of the trench (the portion that is formed in layers 12-14); and a lower portion of the Cu payer in the lower portion of the trench is also wider than an upper portion of the Cu layer in the upper portion of the trench.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-4, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chopra ("Chopra"; 6,413,858) in view of JP'407 (JP 11-317407, 11/16/1999; of record) and/or Liaw et al. ("Liaw"; 5,554,565).

Chopra discloses an interconnection structure for a semiconductor device (Fig. 7; also see col. 6, lines 1-28, and col. 8, lines 54-60), comprising: a trench (14) formed in an ILD film (12; BPSG); a barrier layer (20, 22, and/or 24; Ta, see col. 4, lines 39-43); and a conductive layer (a portion of 26 that is within the trench; Cu) formed in the trench and having an upper portion with a first width and a lower portion with a second width, wherein the second width is wider than the first width. In addition, it is noted that the conductive layer formed in the trench inherently forms a conductive line in the trench, since a trench inherently has a long and narrow structure.

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Chopra does not disclose that the trench can have a bottle-shaped cross section with a wider width at its lower portion. However, one of ordinary skill in the art would readily recognize that it is desirable to have opening structure with a bottle-shaped cross section for preventing the filling material in the opening structure from being adversely easily pulled out, as evidenced in JP'407 (see the ILD (12-14) in Fig. 1d; also see the English abstract); and that such a bottle-shaped opening structure can be readily formed in a BPSG ILD, as evidenced in Liaw (see the ILD (20) in Fig. 1F), wherein a bottom-shaped trench is formed through a simple process. And, in both JP'407 and Liaw, the thickness of the ILD in its upper portion abutting the narrower-width portion of the trench is within the range of about 20-70% of the thickness of the entire ILD.

Therefore, it would have been obvious to one of ordinary skilled in the art at the time the invention was made to make the interconnect structure of Chopra with the cross section of the trench opening being bottle-shaped, as taught by JP'407 and/or Liaw, so that an interconnect structure with the conductive line being hard to be pulled out would be obtained through a simple process.

Response to Arguments

7. Applicant's arguments filed on 6/20/03 have been fully considered but they are not persuasive.

Applicant's main arguments include: The applied prior art references in combination do not teach or suggest the claimed invention, because Chopra teaches a

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trench with a straight sidewalls, and because the opening in either Jp'407 or Liaw is not a trench. In response, the Examiner has recognized these shortcomings and what Appellant argues is not shown by one reference is clearly taught by the other. Thus, these arguments are arguments against the references individually, but clearly these are not proper arguments where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the obviousness rejection, Chopra is cited by the Examiner as teaching a trench interconnection structure which differs from the instant invention only in that the cross section of the trench opening is not bottle-shaped. JP'407 and Liaw are relied on for showing that it was known in the art that an opening formed in an ILD can desirably have a bottle-shaped cross section for preventing the filling material in the opening structure from being adversely easily pulled out, and that such a bottle-shaped opening structure can be readily formed in a BPSG ILD through a simple process. And, one of ordinary skill in the art would be encouraged by the teachings of JP'40-7 and Liaw to make the interconnection structure of Chopra with the cross section of the trench opening being bottle shaped so that the interconnection line in the trench would not be easily pulled out.

Accordingly, all of the claimed elements of the instant invention are clearly present in the collective teachings of Chopra, JP'407 and Liaw.

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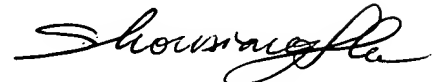
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703) 306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SH
July 31, 2003


SHOUXIANG HU
EXAMINER

SHOUXIANG HU
PRIMARY EXAMINER